~~SEMICONDUCTOR DEVICE AND METHOD OF MAKING~~ INTEGRATED PASSIVE DEVICES

Field of the Invention

The present invention relates in general to semiconductor devices and, more particularly, to a semiconductor device and method of making integrated passive devices.

Background of the Invention

Semiconductor devices are found in many products in the fields of entertainment, communications, networks, computers, and household markets. Semiconductor devices are also found in military, aviation, automotive, industrial controllers, and office equipment. The semiconductor devices perform a variety of electrical functions necessary for each of these applications.

The manufacture of semiconductor devices involves formation of a wafer having a plurality of die. Each semiconductor die contains hundreds or thousands of transistors and other active and passive devices performing a variety of electrical functions. For a given wafer, each die from the wafer typically performs the same electrical function. Front-

Claims

What is claimed:

1. An intermediate structure for a ~~A~~ semiconductor device, comprising:

a first substrate;

a first insulating layer formed over the substrate including a first trench;

an integrated passive device disposed over the first ~~substrate~~ insulating layer;

~~a first insulating layer disposed over the integrated passive device and first substrate;~~

a second insulating layer disposed over the integrated passive device and first substrate including a second trench aligned with the first trench;

a conductive layer formed over the ~~first~~ second insulating layer;

a ~~second~~ third insulating layer formed over the ~~first~~ second insulating layer and conductive layer;

an insulating material disposed continuously in the first trench and the second trench with the first trench and second trench being devoid of conductive material;

~~and~~

a second substrate disposed over the ~~second~~third insulating layer; and

a non-conductive adhesive layer disposed between the third insulating layer and the second substrate.

2. The intermediate structure for ~~T~~the semiconductor device of claim 1, wherein the first substrate includes silicon material.

3. The intermediate structure for ~~T~~the semiconductor device of claim 1, wherein the first substrate includes non-silicon material.

4. The intermediate structure for ~~T~~the semiconductor device of claim 1, wherein the first substrate is made with a material selected from the group consisting of glass, molding compound, epoxy, polymer, and polymer composite.

5. The intermediate structure for ~~T~~the semiconductor device of claim 1, wherein a portion of the conductive layer is wound to exhibit an inductive property.

6. The intermediate structure for ~~T~~the semiconductor device of claim 1, wherein the integrated passive device includes a capacitor or resistor.

7. The intermediate structure for ~~A~~a semiconductor device, comprising:

a first substrate;

an integrated passive device disposed over the first substrate;

a first insulating layer disposed over the integrated passive device and first substrate, the first insulating layer including a first trench;

a second insulating layer disposed between the first insulating layer and first substrate, the second insulating layer including a second trench aligned with the first trench, the first trench and second trench being devoid of conductive material;

an interconnect structure formed over the first insulating layer;

an adhesive layer including resin deposited over the interconnect structure; and

a second substrate disposed over the ~~interconnect structure~~ adhesive layer.

8. The intermediate structure for ~~T~~the semiconductor device of claim 7, wherein the first substrate includes silicon material.

9. The intermediate structure for ~~T~~the semiconductor device of claim 7, wherein the first substrate includes non-silicon material.

10. The intermediate structure for ~~T~~the semiconductor device of claim 7, wherein the first substrate is made with a material selected from the group consisting of glass, molding compound, epoxy, polymer, and polymer composite.

11. The intermediate structure for ~~T~~the semiconductor device of claim 7, wherein the interconnect structure includes:

a conductive layer formed over the first insulating layer; and

a second insulating layer formed over the first insulating layer and conductive layer.

12. The intermediate structure for ~~T~~the semiconductor device of claim 11, wherein a portion of the conductive layer is wound to exhibit an inductive property.

13. The intermediate structure for ~~T~~the semiconductor device of claim 7, further including:

a via formed in the first insulating layer; and

an insulating material disposed in the via.

14. The intermediate structure for ~~A~~a semiconductor device, comprising:

a non-silicon substrate including a material;

a first insulating layer formed over the non-silicon substrate including a trench in the first insulating layer, the trench filled entirely with a material same as the material of the non-silicon substrate;

an integrated passive device disposed over the ~~non-silicon substrate~~ first insulating layer;

a ~~first~~ second insulating layer disposed over the integrated passive device and non-silicon substrate;

a conductive layer formed over the ~~first~~ second insulating layer; ~~and~~

a ~~second~~ third insulating layer formed over the first insulating layer and conductive layer; and

an adhesive layer completely covering a surface of the third insulating layer.

15. The intermediate structure for ~~T~~the semiconductor device of claim 14, wherein the material of the non-silicon substrate is ~~made with a material~~ selected from the group consisting of glass, molding compound, epoxy, polymer, and polymer composite.

16. The intermediate structure for ~~T~~the semiconductor device of claim 14, wherein the material of the non-silicon substrate ~~is made of a material with~~ includes a resistivity of approximately 1000 ohm-cm.

17. The intermediate structure for ~~T~~the semiconductor device of claim 14, wherein a portion of the conductive layer is wound to exhibit an inductive property.

18. The intermediate structure for ~~T~~the semiconductor device of claim 14, wherein the integrated passive device includes a capacitor or resistor.

~~19. The semiconductor device of claim 14, further including:~~
~~a via formed in the first insulating layer; and~~
~~an insulating material disposed in the via.~~

~~20. A semiconductor device, comprising:~~
~~a non-silicon substrate;~~
~~an integrated passive device disposed over the non silicon substrate;~~
~~a first insulating layer disposed over the integrated passive device and non-silicon substrate; and~~
~~an interconnect structure formed over the first insulating layer.~~

~~21. The semiconductor device of claim 20, wherein the non-silicon substrate is made with a material selected from the group consisting of glass, molding compound, epoxy, polymer, and polymer composite.~~

~~22. The semiconductor device of claim 20, wherein the interconnect structure includes:~~
~~a conductive layer formed over the first insulating layer; and~~
~~a second insulating layer formed over the first insulating layer and conductive layer.~~

~~23. The semiconductor device of claim 22, wherein a portion of the conductive layer is wound to exhibit an inductive property.~~

~~24. The semiconductor device of claim 20, wherein the integrated passive device includes a capacitor or resistor.~~

~~25. The semiconductor device of claim 20, further including:~~

~~a via formed in the first insulating layer; and~~

~~an insulating material disposed in the via.~~